Name: ___ Date: ___

Polynomial Operations SOLUTION (version 114)

1. Let polynomials $p(x)$ and $q(x)$ be defined below.

$$p(x) = x^5 + 3x^4 - 5x^2 - 7x - 8$$

$$q(x) = -10x^5 + 6x^4 - 2x^3 + 5x^2 + 1$$

Express the difference $q(x) - p(x)$ in standard form.

Get "unsimplified" forms. Then find $q(x) - p(x)$ with addition/subtraction.

$$\begin{aligned}
p(x) &= (1)x^5 + (3)x^4 + (0)x^3 + (-5)x^2 + (-7)x^1 + (-8)x^0 \\
q(x) &= (-10)x^5 + (6)x^4 + (-2)x^3 + (5)x^2 + (0)x^1 + (1)x^0 \\
q(x) - p(x) &= (-11)x^5 + (3)x^4 + (-2)x^3 + (10)x^2 + (7)x^1 + (9)x^0 \\
q(x) - p(x) &= -11x^5 + 3x^4 - 2x^3 + 10x^2 + 7x + 9
\end{aligned}$$

2. Let polynomials $a(x)$ and $b(x)$ be defined below.

$$a(x) = -2x^2 - 4x + 3$$

$$b(x) = -4x - 2$$

Express the product $a(x) \cdot b(x)$ in standard form.

You can use a table for multiplication.

*	$-2x^2$	$-4x$	3
$-4x$	$8x^3$	$16x^2$	$-12x$
-2	$4x^2$	$8x$	-6

$$a(x) \cdot b(x) = 8x^3 + 16x^2 + 4x^2 - 12x + 8x - 6$$

Combine like terms.

$$a(x) \cdot b(x) = 8x^3 + 20x^2 - 4x - 6$$

3. Express $(x+1)^6$ in standard (expanded) form.

Remember the binomial theorem. It tells us to use Pascal's triangle.

$$x^6 + 6x^5 + 15x^4 + 20x^3 + 15x^2 + 6x + 1$$

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4. Let polynomials $f(x)$ and $g(x)$ be defined below.

$$\begin{aligned} f(x) &= -4x^3 + 28x^2 + 3x - 11 \\ g(x) &= x - 7 \end{aligned}$$

The quotient of $\frac{f(x)}{g(x)}$ can be expressed as a polynomial, $h(x)$, and a remainder, R (a real number).

$$\frac{f(x)}{g(x)} = h(x) + \frac{R}{x-7}$$

By using synthetic division or long division, express $h(x)$ in standard form, and find the remainder R.

I prefer using synthetic division.

$$\begin{array}{c|cccc} & -4 & 28 & 3 & -11 \\ 7 & & -28 & 0 & 21 \\ \hline & -4 & 0 & 3 & 10 \end{array}$$

So,

$$\frac{f(x)}{g(x)} = -4x^2 + 3 + \frac{10}{x-7}$$

In other words, $h(x) = -4x^2 + 3$ and the remainder is $R = 10$.

5. Let polynomial $f(x)$ still be defined as $f(x) = -4x^3 + 28x^2 + 3x - 11$. Evaluate $f(7)$.

You could do this the hard way.

$$\begin{aligned} f(7) &= (-4)\cdot(7)^3 + (28)\cdot(7)^2 + (3)\cdot(7) + (-11) \\ &= (-4)\cdot(343) + (28)\cdot(49) + (3)\cdot(7) + (-11) \\ &= (-1372) + (1372) + (21) + (-11) \\ &= 10 \end{aligned}$$

Or, if you reference the polynomial remainder theorem, you can state that you know $f(7)$ equals the remainder when $f(x)$ is divided by $x - 7$. Thus, $f(7) = 10$.